# Multilayer Laue lenses X-ray nanofocusing optics fabrication

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The high spatial resolution of 10nm and below needed at the next generation of synchrotron beamlines has pushed the development of nanofocusing optics. In the same time, progress in thin film deposition and nanofabrication techniques have broaden the possibilities for fabrication of new devices with larger design flexibility and control. At the crossroads of both fields, multilayer Laue lenses (MLLs) have been receiving increased attention in the last few years [1]. A MLL consists of a depth-graded multilayer which is subsequently sectioned into a high–aspect ratio structure to become a usable optic. Sectioning of multilayered structures into high aspect ratios presents enormous challenges in order to produce high quality MLLs, especially as the aperture size continues to increase. In the past few years, focusing resolution using flat MLLs has been demonstrated to approach the diffraction limit [2]. The growing demand for optics that combine high resolution, large working distance, and high efficiency for hard X-ray microscopy is now pushing the development of large aperture and wedged MLLs. In this presentation, we report our progress on the fabrication of large aperture flat and wedged multilayer Laue lenses [3].

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**References**

[1] Yan, H., et al., Journal of Physics D: Applied Physics **47** (26), 263001 (2014).

[2] Huang, X., et al., Scientific Reports **3**, 3562 (2013)

[3] Huang, X., et al. Optics Express **23** (10) 12496 (2015)